June 3, 2008

Via Electronic Filing

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, SW, TW – A325
Washington, DC 20554

Re: WT Docket Nos. 07-195 & 04-356 – Written Ex Parte Presentation

Dear Ms. Dortch:

As the Commission nears a decision in the above-referenced dockets, the normal frenzy of meetings and filings before the sunshine period has begun. As is too often the case, however, many of these 11th hour filings by other parties lack sufficient nuance and substance, as they ignore the fact that the views expressed therein have *previously* been rebutted on the record and, in the final analysis, disserve the public interest. M2Z files this *ex parte* presentation to recite the significant record evidence in support of several of the key issues before the Commission and to highlight key flaws in some of the more recent advocacy by other parties that are effectively opposing the Commission's goal to promote broadband service.

Regulatory Parity in the Commission's Technical Rules

One need only look to 2.3 GHz WCS to realize that unreasonably strict technical rules in favor of one licensee over another can doom a band from being used for broadband. Despite this stark and ongoing reminder, a handful of parties seem eager to impose unnecessary technical requirements on the 2155-2180 MHz band, even though these impediments would make the band far less useful in promoting Congress's and the Commission's broadband policy objectives. While T-Mobile continues to suggest incorrectly that the Commission should not even try to establish a reasonable OOBE limit that would allow mobile operations in the band[1] and CTIA calls for an unprecedented 10 MHz guard

[1] *See* T-Mobile *Ex Parte*, WT Docket 07-195, at 1 (filed May 23, 2008). T-Mobile claims that the Commission should not attempt to address OOBE limits in a manner that would permit mobile operations in the band, and instead would preclude mobile operations altogether – including any TDD operations – because "mobile-to-mobile interference issues, which would occur by allowing AWS-3 spectrum to be used for mobile operations, are extremely difficult to resolve." *Id.* Technological progress, however, demands that the Commission address all of the issues before it – even the seemingly "difficult" issues. Indeed, the NPRM in this proceeding specifically contemplated this issue, but the Commission nevertheless recognized that technical rules could very well offer a route to resolution: "We also recognize that permitting either of our approaches that include uplink transmissions may raise potentially significant interference issues associated with the presence of both mobile and base station transmissions in the band. We therefore seek comment on methods to address such concerns, including the use of power limits and out-of-band emission restrictions." *Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band*, Notice of Proposed Rulemaking, 22 FCC Rcd 17035, ¶ 2 (2007) ("NPRM").

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band,[2] both parties (along with AT&T) avoid the actual policy question before the Commission: why should the 2.1 GHz band have significantly more stringent technical rules than the 700 MHz band? This question seems especially relevant when the 700 MHz rules: (1) contain a 43 +10 log(p) OOBE limit that was *never* challenged by any CTIA members as providing insufficient adjacent band protection; (2) employ no guard bands between licenses; and (3) explicitly authorize a 700 MHz licensee, at its sole discretion, to determine whether it would use a paired spectrum block in tandem or separately in an unpaired manner (in either or both directions using TDD technology),[3] and thus permits precisely the RF environment that appears to concern some of CTIA's membership – though apparently in this proceeding only. Although carriers have recently called for TDD operations to be precluded from the 2155-2180 MHz band, as far back as 2003 Verizon Wireless understood that the unpaired 2155-2175 MHz band "is likely to be used for fixed services *that employ TDD technology*."[4]

For its part, M2Z has advocated that the Commission avoid recreating the wheel on these technical issues and instead import the commercial 700 MHz technical rules into the 2155-2180 MHz band. M2Z first advocated this position in this proceeding on December 14, 2007,[5] and not one party has sought to rebut this reasonable approach on the merits. Instead, CTIA and T-Mobile continue to argue that more protection is needed and that the proposed technical rules currently before the Commission provide insufficient protection to the AWS-1 licensees.[6] Yet, these parties never have explained why there is a need to abandon the Commission's most recent precedent on this subject, or why such technical rules were acceptable for the band subject to the Commission's most successful auction but not for the 2155-2180 MHz band. While these parties argue for even more stringent OOBE rules in this proceeding, the reality is that (to M2Z's understanding) the technical rules under consideration here would incorporate the strictest OOBE limits for any licensed wireless broadband service – certainly stricter than the rules imposed in 700 MHz and even more stringent than the tight rules imposed in the BRS/EBS band. If the Commission were to follow the logic of CTIA and T-Mobile, it would have a chilling impact on meaningful competition by making two-way broadband access in AWS-3 impossible. This, in turn, would make the spectrum valuable only to those that already have spectrum assets. Such a result is not in the public interest.

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[2] *See* CTIA *Ex Parte*, WT Docket 07-195, at 2 (filed May 29, 2008).

[3] *See, e.g.*, M2Z Reply Comments, WT Docket No. 07-195, at 5 (filed Jan. 14, 2008) ("The AWS-3 and AWS-1 band plans are similar in some respects to the 700 MHz band, and the rules presently under consideration should follow that same approach which permits both paired (*i.e.*, FDD) and unpaired (*i.e.*, TDD) operations throughout the commercial blocks.") (citing 47 C.F.R. § 27.50).

[4] See Letter from Donald Brittingham, Verizon Wireless, to Marlene Dortch, FCC, IB Docket No. 01-185, ET Docket No. 00-258 (Jan. 6, 2003) (emphasis added).

[5] *See, e.g.*, M2Z Comments, WT Docket No. 07-195, at 43 (filed Dec. 14, 2007).

[6] *See supra* notes 1 and 2. Moreover, CTIA set up an internal working group for the purpose of arriving at a consensus position on AWS-3 technical rules. *See* M2Z *Ex Parte*, WT Docket 07-195 (Jan. 30, 2008). The goal of the working group was to file a joint position with the Commission, to the extent the working group could reach consensus on such a position. *Id.* In good faith, M2Z actively participated in the meetings – sending employees and consultants from both the Washington D.C. area and California to attend. While M2Z will not divulge the content of these meetings, one key limitation to the discussions was that parties were not permitted to discuss any aspect of the 700 MHz proceeding. M2Z and others were assured that once the 700 MHz auction concluded, the working group would be able to delve into and resolve these issues. However, nearly concomitant with the end of the auction, the working group ceased to meet without any notice to the participants. Thus, the association never grappled with the question of why certain CTIA member companies were posing much more restrictive technical rules for the 2.1 GHz band than those companies had sought in the successful 700 MHz proceeding. Under these circumstances, M2Z does not believe CTIA's recent filings represent a true "association position."

M2Z, therefore, has hired a respected third party, Alion Science and Technology Corporation ("Alion"),[7] to provide analysis on the impact of the technical rules on AWS-1 and AWS-3 mobile operations. The results of that analysis demonstrate that the Commission would be well served by simply adopting the 43 +10 log(p) emission limit used in the 700 MHz proceeding.[8] As the study from Alion attached as Exhibit A demonstrates, while the use of various OOBE limits between 43 and 60 +10 log(p) dB would have a negligible impact on the capacity of an AWS-1 licensee, each successive limit would have an increasingly negative impact on the amount of useable spectrum available to the AWS-3 licensee.[9] In light of the fact that the Commission has consistently recognized that carriers need 20 MHz of useable spectrum to provide wireless broadband services,[10] the OOBE limit in this band should not be greater than 55 +10 log(p) dB. The imposition of a stricter limit would make the provision of broadband in the AWS-3 band difficult, if not impossible, while providing an imperceptible amount of additional interference protection for AWS-1 licensees.

The table below shows useable AWS-3 bandwidth for tuned frequency restrictions necessary to maintain specific OOBE levels, and the corresponding impact on AWS-1 capacity for various base-station power levels.

[7] Alion Science and Technology Corporation is a technology solutions company with over 3300 employees that delivers technical expertise and operational support to the Department of Defense, civilian government agencies, and commercial customers. Alion provides tools and techniques to optimize the manner in which governments, the military and industry use the electromagnetic spectrum. Alion solutions have been used at major events, such as the 2002 Winter Olympics, and the company has served as an advisor to the Defense Spectrum Office. The company also has supported foreign military spectrum management automation in Germany, Australia, Brazil, and other nations. Alion also maintains one of the largest teams of wireless communication/spectrum management experts in the U.S., and has telecommunications modeling and simulation capabilities including an analytical test bed servicing commercial wireless network communications, civilian and military radar, and military electronic warfare systems. Through its expertise in wireless, Alion has developed specialized models for evaluation of RF propagation, signal processing, and antenna performance.

[8] In addition to Alion's study, M2Z's reply comments explained that any potential interference to the AWS-1 licensees would require the simultaneous occurrence of multiple unrelated events each of which, separately, is unlikely. That filing demonstrates that even if one were to assume no interference mitigation was employed by the AWS-3 licensee, the worst case likelihood of a harmful interference event to an AWS-1 user would be once every few months. However, an analysis of these important findings was not conducted by the parties now seeking heightened interference protection. *See* M2Z Reply Comments, WT Docket No. 07-195, at 13 (filed Jan. 14, 2008).

[9] Alion investigated the impact of various AWS-1 base station transmit power levels. As shown in the Alion report, a significant impact to network capacity was only reported at base station transmission powers *significantly* below those allowed by the AWS-1 technical rules. Those rules allow for a maximum of 69 dBm for a 5 MHz transmission (a value that was liberalized by the Commission after Auction 66). *See In the Matter of Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27 and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services*, WT Docket No. 03-264, Third Report and Order, FCC 08-85, released March 21, 2008.

[10] *See infra* note 21 and accompanying text.

AWS-3 Unilateral OOBE Level (referenced to F-block upper band edge)	**Useable Bandwidth for AWS-3**		**AWS-1 Capacity Impact (at various AWS-1 Base-Station XMT levels)[11]**		
	20 MHz (2155-2175 MHz)	**25 MHz (2155-2180 MHz)**	**BS XMT EIRP 49 dBm**	**BS XMT EIRP 59 dBm**	**BS XMT EIRP 69 dBm**
43 + 10 log (P)	**~19.5 MHz**	**~24.5 MHz**	**18.3%**	**4.1%**	**<0.1%**
55 + 10 log (P)	**~15.0 MHz**	**~20.0 MHz**	**4.4%**	**0.5%**	**<0.1%**
60 + 10 log (P)	**~13.0 MHz**	**~18.0 MHz**	**3.4%**	**<0.1%**	**<0.1%**

Thus, in light of Alion's findings,[12] it is inconsistent with the public interest to establish the type of technical limits proposed by T-Mobile, CTIA, AT&T, and other AWS-1 proponents. These limits proposed by incumbent licensee interests would lead directly to further consolidation and would stifle innovation while providing only illusory interference protection.

Build Out Commitments

M2Z has proposed specific build out obligations to ensure deployment of facilities throughout the United States. Other CTIA members have sought to avoid such obligations, but they do not recognize the fact that the key reason for density-based redlining is the lack of meaningful build out requirements. While MetroPCS, in recent filings, may hope to style itself as a defender of rural broadband deployment, it has failed to embrace perhaps the single most important element of rural broadband deployment – meaningful build out requirements.[13] The Commission must not ignore the fact that the lack of real build out obligations hurts rural areas and disserves the public interest.

Free Service

M2Z supports rules that would jumpstart broadband competition by establishing a free wireless broadband service in the AWS-3 band. Moreover, a free and nationwide broadband service would generate $18-32.4 billion in consumer benefits.[14] MetroPCS and CTIA have been active in three

[11] In the context of AWS-1 licensees, any mobile-to-mobile harmful interference resulting from AWS-3 can be mitigated through a variety of techniques. *See* M2Z March 31, 2008 *Ex Parte* at 2 Moreover, all AWS-1 F-block licensees can use multiple bands (*e.g.*. PCS, 700, 800 MHz) to handle calls should the AWS-1 band experience harmful interference at any point in time.

[12] *See* Alion report, attached as Exhibit A to this letter.

[13] *See* MetroPCS Comments, WT Docket No. 07-195, at 10 ("Stringent build-out mandates have the effect of imposing artificial government-mandated burdens upon licensees.").

[14] *See* Simon Wilkie, "The Consumer Welfare Impact of M2Z Networks Inc.'s Wireless Broadband Proposal," WT Docket No. 07-16, at 3, 8 (submitted Mar. 2, 2007); Kostas Liopiros, "The Value of Public Interest Commitments and the Cost of Delay to American Consumers," WT Docket No. 07-16, at i–ii (submitted Mar. 19, 2007).

proceedings in which M2Z submitted evidence of these benefits, but neither these parties, nor any other party unwilling to provide a free service, has rebutted these figures. Thus, while MetroPCS[15] and CTIA oppose this public interest obligation, these parties do not offer any: (i) quantification of supposed harms or (ii) support for their allegations. In the NPRM, the Commission specifically asked for comment on establishment of a free service. M2Z, along with a majority of commenters addressing the issue of a free service, filed comments in support of such a requirement.[16] MetroPCS and CTIA, however, have both failed to justify their opposition to such a service or to grapple with the substantial, empirical record evidence produced supporting such a requirement.

AWS-2 Resolution

CTIA and MetroPCS have advocated the final resolution of issues involving the H and J bands before the Commission acts here — although their last minute reservations in this regard seem inconsistent with their call for quick action. M2Z has consistently been a champion of moving spectrum to the marketplace quickly. Rapid assignment of spectrum should not be delayed by the whim of individual entities. When the Wireless Bureau dismissed MetroPCS's prior call for delay of the comment and reply comment deadlines in this proceeding based on the applicability of the anti-collusion rules for Auction Nos. 73 and 76, the Bureau noted that "[a]lthough compliance with the Commission's anti-collusion rules is a matter of utmost importance, the fact that these rules are now in effect for Auction Nos. 73/76 should not preclude interested parties from filing meaningful and timely comments regarding service and technical rules in the 2155-2175 MHz band in response to the *AWS-3 NPRM*."[17] The Bureau further noted that "if information arises as a result of the 700 MHz band auction that would affect the AWS-3 proceeding, interested parties may supplement the record by filing *ex parte* comments."[18] MetroPCS passed on that opportunity to comment fully in December 2007 (though it could have done so consistent with the anti-collusion rules), and passed on the chance to supplement the record via *ex parte* any time in the two months since April 3, 2008 – the date the anti-collusion rules for Auction 73 were lifted. Under those circumstances, it makes no sense for the Commission to heed MetroPCS's request for further delay based on its claims that "robust comment on the originally-proposed AWS-3 allocation was stifled because the anti-collusion rule from Auction 73 was in place during the initial comment period."[19] As M2Z highlights in a separate filing today, these bands have been exceedingly slow to come to market and further delay, for any reason, is not warranted.

Moreover, by considering inclusion here of the 2175-2180 MHz band along with the 2155-2175 MHz band, it appears that the Commission is balancing the need for adjacent band interference

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[15] MetroPCS claims that "[a] government-mandated free broadband Internet access service could completely undermine the competitive forces that already are at work to foster additional wireless broadband pipes." *See* MetroPCS *Ex Parte*, WT Docket No. 07-195, at 3 (filed May 30, 2008) ("MetroPCS May 30 *Ex Parte*"). This argument seems to assume some sort of government subsidy for the AWS-3 build out. The reality is that a nationwide AWS-3 licensee will incur substantial expenses to build the network and then must offer a free service. If such an undertaking undermines competitive forces, it is obvious that the marketplace needs additional price discipline.

[16] *See, e.g.*, comments and reply comments filed in WT Docket No. 07-195 on December 14, 2007, or January 14, 2008, respectively, by College Parents of America/Higher Education Wireless Access Coalition at 1-2; County Executives of America (Reply Comments) at 6-7; Electronic Retailing Association at 1; Senator-Elect Lee Yancey at 1; M2Z at 9-15; Minority Media and Telecommunications Council at 7-12; and National Parent Teachers Association (Reply Comments) at 1-3.

[17] *See Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band*, Order, 22 FCC Rcd 21523, ¶ 4 (2007).

[18] *Id.*

[19] *See* MetroPCS May 30 *Ex Parte* at 3.

protection with the need to ensure that broadband services are provided over 20 MHz of useable spectrum. As the Commission recently stated in the *700 MHz Second Report and Order*, spectrum blocks that are 20 MHz or larger "enable a broader range of broadband services (including Internet access at faster speeds), accommodate future higher data rates, and provide operators with additional capacity and, importantly, flexibility."[20] Ensuring at least 20 MHz is also consistent with the Commission's past actions in the AWS-1 band, where it auctioned three 20 megahertz blocks,[21] and in the Upper 700 MHz band where it adopted a 22 MHz block, noting that it would "promote more innovative and efficient broadband deployment" and "stimulate[ ] new entry."[22]

In this proceeding, Sprint Nextel has suggested that one method for dealing with any potential interference issues with adjacent band licensees is for the AWS-3 licensee to establish a 2.5 MHz guard band at the lower and upper band edges.[23] According to Sprint Nextel, "TDD operators in the AWS-3 band cannot place operational TDD channels up to the very edge of the 2155 MHz and 2175 MHz band without their own AWS-3 base station receivers experiencing harmful interference from adjacent-channel base station transmitters. TDD operators in the AWS-3 band therefore must offset their channels by 2.5 megahertz from the AWS-3 band edges to avoid receiving harmful interference from adjacent-channel operators."[24] This solution, however, would leave the AWS-3 licensee with only 15 MHz of useable spectrum and would thus threaten the ability of the license assignment to spur innovation and new entry. Combining the 2155-2175 MHz band with the 2175-2180 MHz band would resolve such issues by ensuring that under the internal guard band scenario, the licensee would retain at least 20 MHz of useable spectrum. In fact, MetroPCS is on record in this proceeding suggesting that the Commission should "<u>take steps to consolidate this proceeding with the AWS-2 proceeding</u>, to consider the two spectrum bands together in assessing the band plan, service rules, and geographic areas, and to make all of the AWS-2 spectrum and the AWS-3 spectrum available for application in a single auction."[25] While MetroPCS seeks further notice regarding the combination of the bands, such notice was already given in the AWS-3 NPRM and need not be repeated. Indeed, the NPRM specifically contemplated the combination of these bands, and sought comment on multiple occasions, on any ideas concerning potential Commission action to prevent harmful interference to adjacent bands:

- "We also seek comment on whether an auction of licenses in a simplified subset of alternative band plans with different technological approaches might be the optimal way to determine which technological approach to implement."[26]

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[20] *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, Second Report and Order, 22 FCC Rcd 15289, ¶ 69 (2007) ("*700 MHz Second Report and Order*") (citing *Service Rules for Advanced Wireless Services in the 1.7 and 2.1 GHz Bands*, Order on Reconsideration, 20 FCC Rcd 14058, ¶ 15 (2005) ("*AWS-1 Order on Reconsideration*")); *see also Service Rules for Advanced Wireless Services in the 1.7 and 2.1 GHz Bands, Report and Order*, 18 FCC Rcd 25162, ¶ 44 (2003).

[21] In the AWS-1 band plan, the Commission auctioned three of the five spectrum blocks (accounting for two-thirds of the total available spectrum) in 20-megahertz blocks. *See AWS-1 Order on Reconsideration* ¶¶ 15, 19-20.

[22] *700 MHz Second Report and Order* ¶ 69.

[23] *See* Sprint Nextel Comments, WT Docket No. 07-195, at 9 (filed Dec. 14, 2007).

[24] *Id.*

[25] *See* Comments of MetroPCS, WT Docket 07-195 , at i, (filed Dec. 14, 2008) (emphasis added). MetroPCS went on to say that "such consolidation is critical in order to maximize the prospect that the spectrum is assigned in the public interest" and that "if one possible use of the AWS-3 Spectrum is to pair it with AWS-2 spectrum, the auction for the spectrum should be consolidated to minimize the exposure risk for applicants and to allow for maximum flexibility. *Id.* at 3, 7.

[26] NPRM ¶ 2.

- "Seek comment on our proposals on the power limits, out-of-band emission restrictions, and other technical or operational requirements that might be needed to prevent harmful interference to operations in adjacent bands."[27]
- "For example, a licensee could specify the 2020-2025 MHz block of AWS-2 as the mobile-transmit block, and combine the corresponding proposed AWS-2 base-transmit block with all of the AWS-3 blocks to form a larger base-transmit block at 2155-2180 MHz, providing a 5:1 ratio (25 megahertz downlink to five megahertz uplink)."[28]
- "AWS-3 base, fixed or mobile stations could cause interference to AWS-1 and proposed AWS-2 services, which will operate in the 2110-2155 MHz and 2175-2180 MHz bands, respectively, as well as other existing services that currently operate in the upper part of the 2.1 GHz band – such as Broadband Radio Service (BRS), Fixed Microwave services (FS) and MSS/ATC. In the following paragraphs, we seek comment on possible technical and operational rules to protect these various services from harmful interference."[29]
- "We therefore seek comment on what OOBE attenuation, beyond our standard 43 + 10log P dB limit, might be required to enable AWS-3 mobiles to protect MSS/ATC mobiles operating in the 2180-2200 MHz band. We also ask whether we should adopt some type of variable out-of-band emission limits based on the particular technologies and system architecture used by AWS-3 licensees to protect such mobiles.[30]

Among other things, the Commission explicitly sought comment on how best to avoid interference with the 2175-2180 MHz band and MSS/ATC mobiles operating in the 2180-2200 MHz band. A logical outgrowth from those questions would be the conclusion that the best way to protect against interference to both 2175-2180 operations and operations in the 2180-2200 MHz band is to avoid licensing the 2175-2180 MHz band separately.[31] M2Z, therefore, supports the combination of 2175-2180 MHz with 2155-2175 MHz as a reasonable and prudent means of managing potential harmful interference between Commission licensees by analyzing and the record across three dockets, rather than in silos. Such an action would accomplish two critical goals: (1) ensuring that there is sufficient bandwidth for broadband operations and (2) ensuring the use of proactive interference management techniques to prevent harmful interference to operations in adjacent bands. Combining portions of AWS-3 and AWS-2 also would achieve the goals articulated by ICO, ensuring that "a solution can be achieved that would provide maximum flexibility for usage of the band, without causing harmful interference to adjacent band licensees."[32]

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[27] *Id.* ¶ 5.

[28] *Id.* ¶ 29.

[29] *Id.* ¶ 49.

[30] *Id.* ¶ 57.

[31] In fact, the AWS-2 proceeding sought comment generally on (1) "power limits, out-of-band emission restrictions, and other technical or operational requirements that might be needed to protect incumbents in adjacent bands from harmful interference"; and (2) "the relative advantages of nationwide licensing"; and that proceeding tentatively concluded that "it should not be necessary to require transmitters operating in the 2175-2180 MHz band to comply with an out-of-band emission limit that is more restrictive than our standard limit of 43 + 10 log P dB." *In the Matter of Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995 2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, 19 FCC Rcd 19263, ¶¶ 1, 29, 105.

[32] ICO Reply Comments, WT Docket No. 07-195, at 2 (filed Jan. 14, 2008); *see also* Comments of T-Mobile, WT Docket No. 07-195, at (filed Dec. 14, 2007) (asserting that the Commission should "facilitate the swift deployment of services over this spectrum, while also ensuring that the provision of services on adjacent AWS-1 spectrum is not jeopardized"); CTIA Comments, WT Docket No. 07-195, at 3 (filed Dec. 14, 2007) ("The Commission therefore should adopt rules for the AWS-3 band that protect operations in adjacent bands from interference. Flexible service rules that protect existing

MSS Issues

On May 30, 2008, ICO Global Communications ("ICO") met with the staff of the Wireless Telecommunications Bureau and the Office of Engineering and Technology and included a presentation that purports to outline proposed service rules in the above-captioned proceedings. ICO's filing, like many of the recently filed submissions, contains critical errors and inconsistencies. For example, ICO claims at that "ICO terminals must meet 70+10 log (P) emission limits at 5 MHz from the edge of the MSS band at 2000-2020 MHz and this should be applied to the AWS-3 mobiles" and that AWS-3 operations should be "similarly" limited.[33] However, the 70 + 10 log (P) restriction is not relevant here. That provision was put in place to protect a large existing base of millions of mobile handsets in the PCS bands.[34] Neither MSS nor AWS-1 have a significantly deployed set of mobile handsets.[35] Moreover, these licensees have no meaningful build-out requirement. Thus, it would be poor public policy to burden the AWS-3 licensee (that will likely have historic build out obligations) to comply with an unreasonable OOBE limitation in order to protect carriers that are not obligated to have a significant nationwide presence.

ICO also argues that the AWS-3 EIRP, if operating up to the 2180 MHz spectral boundary, must be reduced to 1 mW. Such a requirement is inconsistent with MSS ATC transmissions which are at 27 dBW.[36] Indeed, if such a requirement were required to protect ICO, its own operations would pose a significantly larger threat than those of the 2155-2180 licensee. This is because an MSS ATC tower at the significant distance of 500 meters would produce a much stronger interference signal (-9 dBm to -51.5 dBm) on an adjacent band than the 1 mW EIRP transmitter at even shorter distances such as 10 meters (-59 dBm to -64 dBm). A 1 mW EIRP requirement, therefore, is unreasonable in light of the fact that ICO's own systems cannot be that hyper-sensitive otherwise an MSS ATC base station would create blocking to other MSS mobiles at a range of 500 meters or more.

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adjacent channel licensees from interference can appropriately balance the needs of both new and incumbent licensees to the ultimate benefit of consumers.").

[33] *See* ICO *Ex Parte*, WT Docket 07-195, at 5 (filed May 30, 2008).

[34] *See* 47 CFR § 25.252(b)(2).

[35] CTIA argues that without strict OOBE limits "millions of American consumers will experience lost calls . . . ." *See* CTIA *Ex Parte*, WT Docket 07-195, at 1 (filed May 29, 2008). CTIA, however, does not explain that there simply are not millions of handsets in either the AWS-1 or the MSS ATC bands.

[36] *See* 47 CFR § 25.252(a)(2).

Pursuant to Section 1.1206(b) of the Commission rules, an electronic copy of this letter is being filed. Please let me know if you have any other questions regarding this submission.

Sincerely,

Uzoma C. Onyeije

CC: Mr. Aaron Goldberger, Mr. Bruce Gottlieb, Ms. Renee Crittendon, Mr. Wayne Leighton, Ms. Angela Giancarlo, Mr. Joel Taubenblatt, Mr. Peter Daronco, Mr. Julie Knapp, Mr. Ira Keltz, Mr. Marty Liebman, Mr. Patrick Forster, Mr. Jamison Prime

Attachment A

AWS-3 to AWS-1 Mobile-to-Mobile Interference Effects

Preliminary Analysis Results

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30 May 2008

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Executive Summary

The Federal Communications Commission (FCC) is currently considering service rules for fixed and mobile services, including Advanced Wireless Services (AWS), in the 2155-2175 MHz band. In the AWS-3 service rules NPRM,[1] the FCC requested comment on how to establish rules that would ensure the coexistence of mobile equipment in the AWS-3 adjacent bands. Specific technical issues identified by the FCC include potential coexistence related to licensing time division duplex ("TDD"). TDD operations in the AWS-3 band, power limits, out-of-band emissions restrictions, and other technical requirements.

At the request of M2Z Networks, Inc., Alion investigated the impact of AWS-3 mobile operations to AWS-1 mobile operations if the AWS-3 band was used for two-way radio operation using a TDD configuration. M2Z also requested that Alion extend the analysis to cover mobile TDD operations up to 2180 MHz. The analysis did not investigate the potential for interference from AWS-1 to AWS-3 base stations.

To address the specific issues of AWS-3 TDD operations and their impact on adjacent band operations, Alion utilized a 2-step approach, where in the first step it identified the worst case scenario for interference using static assumptions where AWS-3 and AWS-1 devices are in extremely close proximity (separated by one meter) and where the AWS-1 device is operating at near the minimum desired signal level. Under these specific circumstances, the frequency separations required to preclude interference between AWS-1 and AWS-3 are impractical to implement and are spectrally inefficient.

The potential for interference under these worst case conditions provided in the static analysis is not a true indicator for overall impact of interference in an operational deployment.[2] Actual operations include a wide range of undesired and desired signal conditions for which only a small subset may result in interference. Thus, as a second step in its analysis, Alion utilized a Monte-Carlo analysis[3] performed using an industry-

[1] *In the Matter of Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band*, WT Docket No. 07-195, Notice of Proposed Rulemaking, FCC 07-164, released 19 September 2007.
[2] Moreover, the analysis does not include the use of any active mitigation techniques being considered by M2Z. Analysis of the effects of such mitigation techniques was beyond the scope of this preliminary analysis effort
[3] Monte Carlo methods are useful for modeling phenomena with significant uncertainty in parameters, such as the probability of random mobile devices being in close proximity to each other.

standard model, SEAMCAT.[4] The SEAMCAT analysis quantified the average capacity loss of an AWS-1 network when considering the random variations in parameters of operational deployments.

The Monte-Carlo analysis applied assumptions and a range of parameters to define various conditions and tradeoffs for the coexistence of AWS-3 operations with an AWS-1 licensee. Notably, the attached analysis assumes:

- Nearly four times the density AWS-3 mobiles as AWS-1 mobiles,
- The maximum transmit power capability of AWS-1 base stations may range from well below and up to the permitted power levels for AWS-1 base station transmissions; and ,
- Three possible out-of-band emission (OOBE) levels, corresponding to three minimum frequency separations between AWS-3 and AWS-1 devices.

The table below shows a summary of the results of the statistical analysis assuming the use of 2155-2175 MHz or 2155-2180 MHz for TDD operations to provide broadband services.

AWS-3 Unilateral OOBE Level (referenced to F-block upper band edge at 2155 MHz)	**Useable Bandwidth for AWS-3**		**Impact on AWS-1 Capacity (at various AWS-1 Base-Station XMT levels)**		
	20 MHz (2155-2175 MHz)	**25 MHz (2155-2180 MHz)**	**BS XMT EIRP 49 dBm**	**BS XMT EIRP 59 dBm**	**BS XMT EIRP 69 dBm**
43 + 10 log (P)	**~19.5 MHz**	**~24.5 MHz**	**18.3%**	**4.1%**	**<0.1%**
55 + 10 log (P)	**~15.0 MHz**	**~20.0 MHz**	**4.4%**	**0.5%**	**<0.1%**
60 + 10 log (P)	**~13.0 MHz**	**~18.0 MHz**	**3.4%**	**<0.1%**	**<0.1%**

The table shows usable AWS-3 bandwidth for tuned frequency restrictions necessary to maintain specific OOBE levels, and corresponding impact on AWS-1 capacity for various base-station power levels. Under several of the scenarios the AWS-1 is predicted

[4] The Spectrum Engineering Advanced Monte-Carlo Tool (SEAMCAT) was developed by the European Conference of Postal and Telecommunications Administrations (CEPT) Spectrum Engineering Working Group to model the statistical variability of desired and undesired signal levels and determine the associated likelihood of impact to desired communications links. This tool was found to be particularly well suited to the analysis of adjacent band interference to the AWS-1 band because it can model the power control loops of CDMA systems such as UMTS, which are planned for use by several network operators having licenses in the AWS-1 band.

to experience a loss of capacity of less than 0.1% when operating consistent with the FCC's recently liberalized base station transmission power limits.[5] The results also show that impact on AWS-1 operations can be minimized at lower than authorized AWS-1 powers (e.g., 59 dBm EIRP) if the AWS-3 OOBE is 55 + 10log (P). While the table above and our analysis seeks to measure interference, Alion did not address the policy question of whether the interference could be characterized as harmful as defined in the Federal Communications Commission's rules.

The number of deployment iterations and systems' parameter variations was limited to a few representative cases in this preliminary analysis. Additional cases may be explored to develop a more complete characterization of the possible scenarios and system parameter excursions.

[5] Recent changes in FCC base station transmission power limits allow for increase signal levels and thus the reduced loss of capacity. The 69 dBm EIRP represents the current regulatory limits for a 5 MHz emission. *See: In the Matter of Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27 and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services*, WT Docket No. 03-264, Third Report and Order, FCC 08-85, released March 21, 2008, available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-85A1.pdf.

Introduction

The Federal Communications Commission (FCC) is currently considering service rules for fixed and mobile services, including Advanced Wireless Services (AWS), in the 2155-2175 MHz band. In the AWS-3 service rules NPRM,[6] the FCC requested comment on how to establish rules that would ensure the coexistence of mobile equipment in the AWS-3 adjacent bands. Specific technical issues identified by the FCC include potential coexistence related to licensing TDD operations in the AWS-3 band, power limits, out-of-band emissions restrictions, and other technical requirements.

Previous evaluations by M2Z indicate that the occurrence of interference between AWS-1 and AWS-3 mobile units is unlikely in an operational scenario.[7] In order to build the body of evidence and provide additional analytical depth to support M2Z's positions and findings concerning the conditions and likelihood of interference, M2Z asked Alion Science and Technology (Alion) to provide engineering support services. This report provides a summary the preliminary results of an analysis of coexistence between prospective AWS-3 mobile units interspersed with AWS-1 mobile units in an operational setting. M2Z also requested that Alion extend the analysis to cover mobile TDD operations up to 2180 MHz. The preliminary analysis results indicate that, in the extreme case, interference from AWS-3 TDD devices can introduce interference into AWS-1 devices located in close proximity (e.g., one meter separation) and with small frequency separations. However, a statistical analysis based on Monte-Carlo simulation techniques predicts relatively low probabilities of interference (expressed as AWS-1 capacity reduction) between AWS-3 mobile equipment, and AWS-1 mobile equipment. When certain frequency tuning restrictions are applied to the AWS-3 band plan, the interference effects become reduced further.

Approach Overview

Alion evaluated the potential for AWS-3 mobiles to interfere with AWS-1 mobiles in two stages — a hypothetical "one-on-one" analysis and a statistical Monte-Carlo simulation. In both analysis stages the characteristics of the AWS-1 mobiles were based on UMTS network deployments planned for adjacent frequency bands. Since M2Z's AWS-3

[6] *In the Matter of Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band*, WT Docket No. 07-195, Notice of Proposed Rulemaking, FCC 07-164, released 19 September 2007.
[7] *M2Z Networks AWS-3 Reply Comments*, WT Docket No. 07-195, filed 14 January 2008.

equipment is not yet available, the AWS-3 characteristics were based on theoretical modeling combined with measured data available for similar equipment.

In the first stage, a hypothetical "one-on-one" analysis was performed to quantify the interference interactions between mobile units at a separation distance of one meter, and desired signal levels near minimum, as they might be at the edge of the cell. This one-on-one analysis included parametric variations (for example, variations of emission mask or receiver filter tuning) to identify dominant mechanisms, effects and key parameter ranges affecting the interference interaction. The results provided minimum frequency separations that are predicted to maintain coexistence by ensuring undesired signals are below threshold interference levels (where threshold interference levels are derived from industry reports available in the NPRM proceedings).[8]

In the second stage, the characteristics of the AWS-1 and AWS-3 mobiles were entered into a statistical Monte-Carlo simulation, called SEAMCAT. In this simulation, multiple hypothetical operational deployments of both AWS-1 and AWS-3 mobiles are generated to derive statistical representations of their geographic separations, corresponding propagation loss values and other parameters determinative of interference interactions. The combined effects of blocking (i.e., receiver overload) and out-of-band emissions (OOBE) are calculated for each of the multiple deployment configurations, and a representation of interference statistics is derived, and transformed into "capacity loss" for a representative AWS-1 cell, or system. Due to recent changes in transmission power rules after the AWS-1 auction, we investigated the impact of using various base-station power levels to analyze the effect of both the original and modified maximum authorized transmission power levels.[5]

One-on-One Analysis

Two interference mechanisms were addressed: OOBE and Receiver Overload (Blocking). For the blocking effects, an interference threshold of -29.0 dBm[8] was adopted, referenced to the antenna input of the AWS-1 mobile device. For the OOBE effect, an interference threshold was derived as the level admitted in a single AWS-1 channel receiver pass-band corresponding to an average spectral power density of -159.7 dBm/Hz, based on a desired received signal level of -100 dBm.[8]

[8] *Verizon Wireless AWS-3 Comments*, WT Docket No. 07-195, filed 14 December 2007; *Motorola AWS-3 Comments*, WT Docket No. 07-195, filed 17 December 2007.

Adjacent-band interference is possible when transmitters emit signals outside their licensed band, and/or when a receiver passband extends into an adjacent band. Alion evaluated the potential one-on-one case for adjacent-channel interference from M2Z ASW-3 mobile transmitters to AWS-1 mobile receivers by using available data characterizing the AWS-3 transmitter emission spectrum and AWS-1 receiver selectivity. The effective frequency-separation-dependent interference power suppression was calculated by applying automated models based on computed convolution integrals of transmitter emission and receiver filter rejection (suppression) characteristics. For this preliminary analysis, a one meter distance separation was applied, corresponding to a free-space propagation loss of 39.1 dB. An additional 6 dB of coupling losses was also added to compensate for body losses and antenna mismatches/inefficiencies.

As part of the one-on-one calculations, parametric excursions of the impact of increased frequency separation, along with calculations reflecting the impact of better transmitter and receiver filtering, or variations on transmitter noise floor characteristics were performed to help identify whether and under what conditions the OOBE or the blocking mechanisms are likely to dominate the coexistence state. Alternatives were evaluated by varying design parameters, such as filter characteristics, power, and guard-bands to identify a reasonable estimate of minimum required frequency separation. The minimum required frequency separation is defined as the minimum AWS-3 carrier offset (referenced to the AWS-3 lower band-edge) that is required to maintain the interference to an AWS-1 receiver (tuned to the highest F-block channel) below the thresholds defined above.

The results show that predicted interference may exceed the established thresholds at a one meter separation. The frequency offset needed to maintain interference below the threshold is summarized for a representative sample of scenarios as listed in Table 1, below. In all cases, a theoretical OFDM curve was used to model the emission mask down to the point where spectral power density was 50 dB below the tuned frequency. A conservative (pessimistic) emission mask was used to represent transmitter noise beyond the frequencies where spectral power density was 50 dB or more below the carrier. This was done because the AWS-3 devices are under design, and the ability to suppress transmitter noise is unknown. Two AWS-3 bandwidths were modeled… one at 400 kHz and one at 3.5 MHz. Note that the results for the blocking mechanism are given for two AWS-1 duplexer conditions. The first is a nominal condition where the duplexer passband extends well beyond the designated AWS-3 and AWS-2 frequency bands. The second is a condition where the passband has been optimized to suppress adjacent band signals by putting the upper 3-dB breakpoint of the duplexer at the upper F-block boundary.

Table 1
Results of One-On-One Interference Analysis for One-Meter Separation between AWS-1 and AWS-3 Mobile Units

AWS-3 Emission BW	AWS-1 Duplexer 3 dB Breakpoint	Min Freq Offset	Lowest AWS-3 Tuned Freq	Interference Mechanism
400 kHz	2186 MHz (nominal)	> 25MHz	Above 2180 MHz	Blocking
400 kHz	2155 MHz (optimal)	14.0 MHz	2169 MHz	Blocking
3.5 MHz	2186 MHz (nominal)	> 25MHz	Above 2180 MHz	Blocking
3.5 MHz	2155 MHz (optimal)	14.1 MHz	2169.1 MHz	Blocking
400 kHz	2186 MHz (nominal)	> 25MHz	Above 2180 MHz	OOBE
3.5 MHz	2186 MHz (nominal)	> 25MHz	Above 2180 MHz	OOBE
3.5 MHz (optimized Tx filter)	2186 MHz (nominal)	10.3 MHz	Above 2165.3 MHz	OOBE

The results show that under these worst-case assumptions, there is potential for interference. However, these results presume close proximity and minimal AWS-1 signal conditions. For example, when distance separations of 10m are analyzed, the required frequency separations are reduced significantly[9]. Similarly, adding optimized transmitter filtering to the AWS-3 device has significant effects. This one-on-one analysis served to provide insight to the interference mechanisms and established that there is potential for interference. This one-on-one analysis could not address all possible variations of distance, other deployment attributes, and their relative probabilities of occurrence. The impact of AWS-3 TDD on actual capacity of AWS-1 operations must be addressed statistically to account for the dynamics of mobile deployments, desired signal, and effects of UMTS power control processing.

Statistical SEAMCAT Analysis

A preliminary statistical analysis of the potential for out of band emission and receiver overload interference from AWS-3 TDD mobiles to AWS-1 UMTS FDD mobiles was performed using version 3.1.43 of the Spectrum Engineering Advanced Monte-Carlo

[9] Using free-space (r^2) propagation loss, the impact would be a reduction of 20 dB in interfering power, significantly reducing frequency separation required to meet threshold levels.

Tool (SEAMCAT) developed by the European Conference of Postal and Telecommunications Administrations (CEPT) Spectrum Engineering Working Group. SEAMCAT is able to model the statistical variability of the desired and undesired signal levels and determine the associated likelihood of impact to desired communications links. Version 3 of this tool was found to be particularly well suited to the analysis of adjacent band interference to the AWS-1 band because it includes algorithms specific to the modeling of the power control loops of CDMA systems such as UMTS, which are planned for use by several network operators having licenses in the AWS-1 band. The essential concept of the model is described in ERC Report 68[10]. The on-line SEAMCAT user's manual is available at http://www.seamcat.org/xwiki/bin/view/Main/ and additional supporting information can be obtained from the ERO's website at: http://www.ero.dk/.

Representation of AWS-1 within SEAMCAT

Within SEAMCAT, AWS-1 mobile users were modeled as a component of a UMTS network centered at 2152.5 MHz, which is 2.5 MHz below the AWS-3 band edge. This is the closest, and thus most susceptible, placement of the UMTS to the band edge. The geographic network configuration modeled is shown in Figure 1. SEAMCAT evaluates the impact of interference on the network by quantifying lost capacity in the reference cell. At the beginning of the simulation, the capacity without interference is determined, then interferers are introduced, and the additional dropped calls due to interference are determined. Simulation of the CDMA downlink power control loop is the key process in determining dropped calls. Because the effect of interference at a mobile is also dependent on the noise from other basestations, it is necessary to also simulate the operation of adjacent cells. The default within SEAMCAT is to model two rings of cells around the reference cell. A cell wrap-around technique is used to avoid boundary artifacts. For power balancing purposes, this simulates the effect of virtually infinite laydown.

[10] Monte-Carlo Simulation Methodology for the use in Sharing and Compatibility Studies between different Radio Services or Systems, ERC Report 68, June 2002 revision, available at: http://www.erodocdb.dk/Docs/doc98/official/pdf/REP068.PDF.

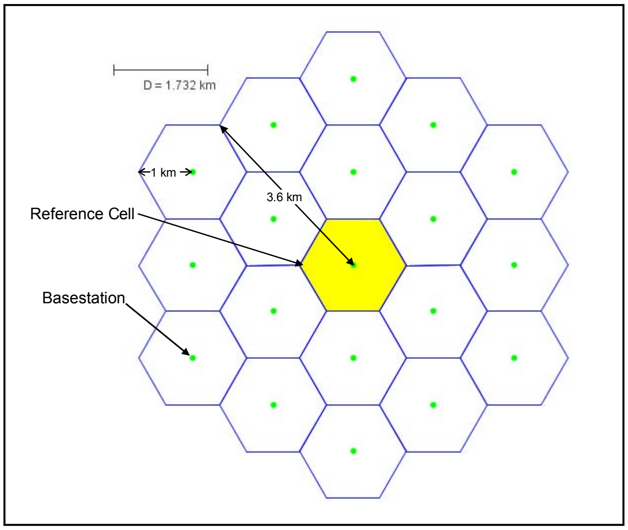

Figure 1. Modeled UMTS laydown.

The link performance characteristics of the base-station-to-mobile link were represented using a standard UMTS model included with the SEAMCAT download. This model, which was developed by Lucent Technologies, describes the Ec/Ior requirements of mobiles for 12.2 kbps voice as a function of mobility. The four mobility categories modeled are stationary, 3 km/h, 30 km/h, and 100 km/h. The default operation of the model is to allocate 25% of the mobiles to each category.

The Extended Hata model was used to model both desired and undesired signal paths. A propagation environment characterized as "suburban", "outdoor", and "above roof" was assumed. The values of other important UMTS parameters are summarized in Table 2. The non-interfered cell capacity of 94 was determined by the SEAMCAT model before introducing interferers. It represents the maximum number of mobiles within a cell for which the probability of no dropped call will be at least 80%.

Table 2
AWS-1 Simulation Parameter Values

Simulation Parameter	Value
Cell radius	1 km
Basestation antenna height	30 m
Basestation antenna	9 dBi omni
Mobile antenna height	1.5 m
Mobile antenna	0 dBi omni
Propagation model	Extended Hata
Cell capacity	94 (36.2/km²)
Mobile voice activity factor	50%

UMTS mobiles were assumed to be equipped with an RF front-end filter similar to the Avago Technologies model ACMD-7601 UMTS Band I duplexer. The nominal receive band filter characteristics are shown in Figure 2. Note that in the 2155 – 2180 MHz band, this filter provides no attenuation other than an insertion loss of about 1.6 dB. However, based on receiver overload measurements noted by Verizon and Motorola in their inputs[8] to the FCC rule-making on service rules for advanced wireless services in the 2155 – 2175 MHz band, an overload rejection value of 65 dB was assumed. Verizon had indicated in their FCC filing that an overload interference level of -42 dBm at the input to a typical CDMA receiver corresponds to the onset of receive impairment at a desired signal level of -105 dBm. In the SEAMCAT model, 65 dB of overload rejection applied to a -42 dBm receiver input signal would result in an undesired signal power of -107 dBm, which according to Motorola's filing would result in 4.5-5% frame errors when receiving a -105 dBm desired signal.

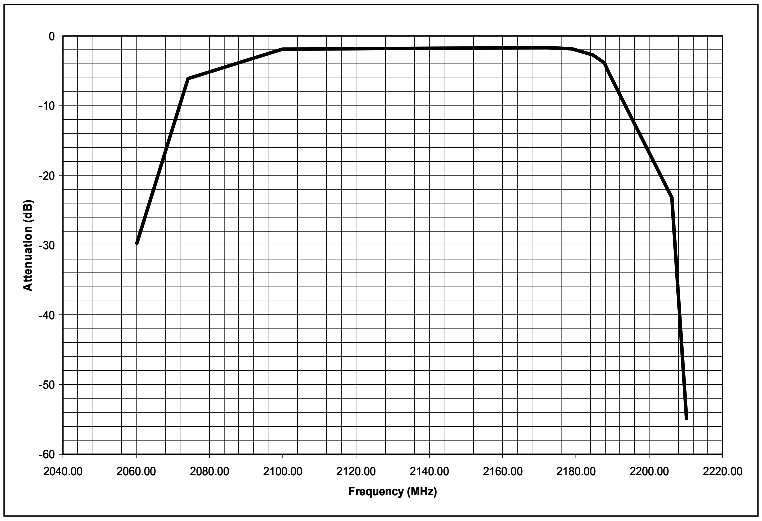

Figure 2. Representative AWS-1 receiver front-end filter characteristic

The AWS-1 power applied in the model is expressed as effective isotropic radiated power (EIRP). Three values were applied to demonstrate the parametric variations for different maximum power limits for a base station operation: 69 dBm, 59 dBm and 49 dBm. The highest EIRP value (69 dBm) is an approximation of the allowable power in a 5 MHz channel under the current (recently revised) regulatory limit defined in Section 27.50 of the FCC Rules and Regulations; wherein the limit is defined for dense population areas as 1640 Watts/MHz. The 59 dBm EIRP value was chosen to represent a likely power limit that may have been applied to a 5 MHz channel in keeping with prior rules. A 49 dBm EIRP was also applied to demonstrate the dependence of the analysis results on AWS-1 power assumptions, primarily as a variation used to show parametric sensitivity of the model. Note that the SEAMCAT model uses these power limits as a maximum excursion to model downlink power control in a UMTS base station.

Representation of AWS-3 Mobiles within SEAMCAT

Although AWS-3 mobiles will form part of a point to multipoint WiMax network, they were represented in the simulation as emitters evenly distributed in a 3.6 km radius about the center of the reference cell (see Figure 1) with a density of 125 mobiles per km². Each mobile was assumed to be equipped with a 0 dBi antenna and have an EIRP of +33dBm. The emission mask is presented in Figure 3. Off-tunings of 2.73, 4.9, and 5.96 MHz from the AWS-1 band edge were considered. The AWS-3 mobile transmitter output power level in a 1 MHz band at these off-tunings are -43 dBW, -55 dBW, and -60 dBW, respectively which correspond to OOBE technical rules of 43 + 10 log (P), 55 + 10 log (P), and 60 + 10 log (P).

Offset (MHz)	Mask (dBc)	Ref. bw (kHz)
-84.0	-103.44068	1,000.0
-42.0	-91.44068	1,000.0
-21.0	-79.44068	1,000.0
-10.5	-67.44068	1,000.0
-5.25	-55.440680...	1,000.0
-4.25	-47.440680...	1,000.0
-2.75	-42.440680...	1,000.0
-2.25	-35.440680...	1,000.0
-1.76	-27.440680...	1,000.0
-1.75	-5.4406804...	1,000.0
0.0	-5.4406804...	1,000.0
1.75	-5.4406804...	1,000.0
1.76	-27.440680...	1,000.0
2.25	-35.440680...	1,000.0
2.75	-42.440680...	1,000.0
4.25	-47.440680...	1,000.0
5.25	-55.440680...	1,000.0
10.5	-67.44068	1,000.0
21.0	-79.44068	1,000.0
42.0	-91.44068	1,000.0
84.0	-103.44068	1,000.0

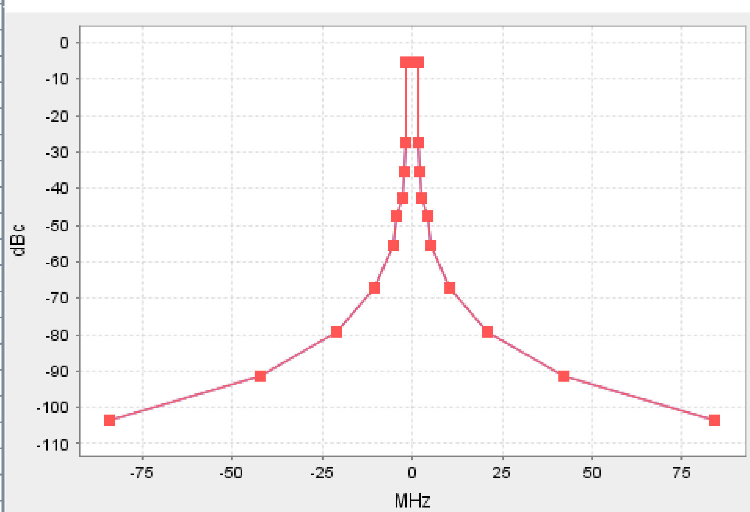

Figure 3. AWS-3 mobile emission spectrum mask.

SEMCAT Simulation Results

The primary output of the SEAMCAT simulation is the percentage of average capacity loss in the reference cell. Capacity is considered lost when interference results in additional dropped calls. A call is dropped if the achieved Ec/Ior at the UMTS mobile does not exceed the required Ec/Ior by the call-drop threshold. The average capacity loss as a function of UMTS basestation power and AWS-3 off-tuning are summarized in the table below.

Table 3
Summary of SEAMCAT Simulation Results

SEAMCAT Run	AWS-3 Frequency (MHz)	AWS-3 Power at Band Edge (dBW/MHz)	Number of Trials	UMTS EIRP (dBm)	UMTS Cell Diameter (km)	Users per UMTS Cell	AWS-3 Interferers per km²	Mean OOBE (dBm)	Mean Blocking (dBm)	% Average Capacity Loss (Ref Cell)
1	2157.73	-43	20	49	1	94	125	-94.04	-117.11	18.26
2	2159.9	-55	20	49	1	94	125	-98.17	-111.21	4.39
3	2160.96	-60	20	49	1	94	125	-100.06	-110.47	3.39
4	2157.73	-43	20	59	1	94	125	-88.23	-111.3	4.09
5	2159.9	-55	20	59	1	94	125	-97.25	-110.28	0.45
6	2160.96	-60	20	59	1	94	125	-99.51	-109.92	0.07
7	2157.73	-43	20	69	1	94	125	-87.17	-110.24	0.00
8	2159.9	-55	20	69	1	94	125	-97.87	-110.91	0.06
9	2160.96	-60	20	69	1	94	125	-99.12	-109.52	0.00

Summary, Conclusions, Limitations and Issues

This preliminary analysis of coexistence between AWS-1 and AWS-3 mobile devices produced the following results.

1. Under worst-case conditions where the devices are separated by only one meter and the AWS-1 receiver is operating near a minimum desired signal level, the frequency separation required to suppress interference below threshold levels is excessive. When considering the combined effects of OOBE and blocking, the required separation (referenced to the upper boundary of F-block channels) can be as little 14 MHz, or greater than 25 MHz depending on transmitter noise characteristics and duplexer/filter characteristics of the deployed devices.

2. Actual effects of interference on the AWS-1 deployments are highly dependent on a large number of interrelated, dynamically-varying parameters (distance, desired signal, power control, propagation paths, etc.). Consequently, analysis of the actual impact on an AWS-1 system was addressed statistically.

3. The table below shows a summary of the results of the statistical analysis assuming the use of 2155-2175 MHz or 2155-2180 MHz for TDD operations to provide broadband services.

AWS-3 Unilateral OOBE Level (referenced to F-block upper band edge at 2155 MHz)	Useable Bandwidth for AWS-3		Impact on AWS-1 Capacity (at various AWS-1 Base-Station XMT levels)		
	20 MHz (2155-2175 MHz)	25 MHz (2155-2180 MHz)	BS XMT EIRP 49 dBm	BS XMT EIRP 59 dBm	BS XMT EIRP 69 dBm
43 + 10 log (P)	~19.5 MHz	~24.5 MHz	18.3%	4.1%	<0.1%
55 + 10 log (P)	~15.0 MHz	~20.0 MHz	4.4%	0.5%	<0.1%
60 + 10 log (P)	~13.0 MHz	~18.0 MHz	3.4%	<0.1%	<0.1%

The table shows usable AWS-3 bandwidth for tuned frequency restrictions necessary to maintain specific OOBE levels, and corresponding impact on AWS-1 capacity for various base-station power levels. Under several of the scenarios the AWS-1 is predicted to experience a loss of capacity of less than 0.1% when operating consistent with the FCC's recently liberalized base station transmission power limits.[5] The results also show that impact on AWS-1 operations can be minimized at lower than authorized AWS-1 powers (e.g., 59 dBm EIRP) if the AWS-3 OOBE is 55 + 10log (P). While the table above and our analysis seeks to measure interference, Alion did not address the policy question of whether the interference could be characterized as harmful as defined in the Federal Communications Commission's rules.

4. Statistical analysis of a limited number of sample deployments using the SEAMCAT model indicates that the probability of interference and consequent impact on AWS-1 capacity may be relatively small. However, the number of deployment iterations and systems' parameter variations was limited to a few representative cases in this preliminary analysis. Additional cases should be explored to develop a more complete characterization of the possible scenarios and system parameter excursions.